WHAT IS CLAIMED IS:

1. A method of generating a dictionary for detecting a specified mark, comprising the steps of:

inputting a dictionary image;

generating a coordinate conversion table containing a list of corresponding coordinates between a predetermined XY coordinate and a predetermined polar coordinate for converting the inputted dictionary image into polar coordinates, the polar coordinates being expressed by a central distance to a predetermined center and a central angle; and

generating a polar coordinate image for the dictionary from the dictionary image based upon the coordinate conversion table.

2. The method of generating a dictionary according to claim 1 wherein the dictionary image contains pixels, the central distance being in a central direction scale indicative of a distance between a center of each of the pixels and a center of the dictionary image in the predetermined XY coordinate, and the central angle being in a central rotation direction scale indicative of a degree of rotation of the dictionary image.

3. The method of generating a dictionary according to claim 2 wherein the central distance being clustered into clusters, each of the clusters in the central direction being expressed by the polar coordinate.

4. The method of generating a dictionary according to claim 3 wherein the clustering is performed based upon the central direction scale so that correspondence is one-to-one between the pixels between the dictionary image and the polar coordinate image as expressed in the polar coordinate.

5. The method of generating a dictionary according to claim 3 wherein the clustering is performed based upon the central direction scale so that a substantial difference is prevented in characteristics value between the central direction scale and the central rotation direction scale.

6. The method of generating a dictionary according to claim 2 wherein a rotated image is being rotated based upon the central angle, pixels having the same central direction scale being extracted from the rotated image, pixel values in the polar coordinate being determined based upon the extracted pixels.

7. The method of generating a dictionary according to claim 2 wherein one of the pixels having the same distance in the central direction is selected, the central angle of the selected pixel being used as a standard, the central rotation direction scale of other pixels having the same distance in the central direction being set to the central rotation direction scale of the standard.

8. The method of generating a dictionary according to claim 7 wherein a rotated image is being rotated based upon the central angle of the standard, pixels having the same central direction scale being extracted from the rotated image, in determining pixel values in the polar coordinate based upon the extracted pixels, a weight value being made large for a pixel value of the standard.

9. The method of generating a dictionary according to claim 8 further comprising the additional steps of:

storing the coordinate conversion table and the polar coordinate image in a dictionary;

rotating to reconstruct an image based upon the coordinate conversion table; and

comparing the reconstructed image and specified mark candidates to determine the specified mark.

10. The method of generating a dictionary according to claim 8 further comprising the additional steps of:

storing the coordinate conversion table and the polar coordinate image in a dictionary;

rotating to reconstruct an image based upon the coordinate conversion table; and comparing pixels between the reconstructed image and specified mark candidates to determine the specified mark.

11. A method of generating a dictionary for detecting a specified mark, comprising the steps of:

inputting a specified mark image;

converting the specified mark in a polar coordinate image expressed by a central distance to a predetermined center and a central angle;

storing the polar coordinate image in a dictionary;

rotating the polar coordinate image; and

comparing the rotated polar coordinate image and specified mark candidates to determine the specified mark.

12. A method of generating a dictionary for detecting a specified mark, comprising the steps of:

inputting a specified mark image;

converting the specified mark in a polar coordinate image expressed by a central distance to a predetermined center and a central angle;

storing the polar coordinate image in a dictionary;

rotating the polar coordinate image; and

comparing pixels in the rotated polar coordinate image and corresponding pixels in specified mark candidates to determine the specified mark.

13. A computer program containing instructions for generating a dictionary and for detecting a specified mark, the instructions comprising the tasks of:

inputting a dictionary image;

generating a coordinate conversion table containing a list of corresponding coordinates between a predetermined XY coordinate and a predetermined polar coordinate for converting the inputted dictionary image into polar coordinates, the polar coordinates being expressed by a central distance to a predetermined center and a central angle; and

generating a polar coordinate image for the dictionary from the dictionary image based upon the coordinate conversion table.

14. The computer program containing instructions according to claim 13 wherein the dictionary image contains pixels, the central distance being in a central direction scale indicative of a distance between a center of each of the pixels and a center of the dictionary image in the predetermined XY coordinate, and the central angle being in a central rotation direction scale indicative of a degree of rotation of the dictionary image.

15. The computer program containing instructions according to claim 14 wherein one of the pixels having the same distance in the central direction is selected, the central angle of the selected pixel being used as a standard, the central rotation direction scale of other pixels having the same distance in the central direction being set to the central rotation direction scale of the standard.

16. The computer program containing instructions according to claim 15 wherein a rotated image is being rotated based upon the central angle of the standard, pixels having the same central direction scale being extracted from the rotated image, in determining pixel values in the polar coordinate based upon the extracted pixels, a weight value being made large for a pixel value of the standard.

17. The computer program containing instructions according to claim 16 further comprising the additional tasks of:

storing the coordinate conversion table and the polar coordinate image in a dictionary;

rotating to reconstruct an image based upon the coordinate conversion table; and

comparing the reconstructed image and specified mark candidates to determine the specified mark.

18. The computer program containing instructions according to claim 16 further comprising the additional tasks of:

storing the coordinate conversion table and the polar coordinate image in a dictionary;

rotating to reconstruct an image based upon the coordinate conversion table; and

comparing pixels between the reconstructed image and specified mark candidates to determine the specified mark.

19. A computer program containing instructions for generating a dictionary and for detecting a specified mark, the instructions comprising the tasks of:

inputting a specified mark image;

converting the specified mark in a polar coordinate image expressed by a central distance to a predetermined center and a central angle;

storing the polar coordinate image in a dictionary;

rotating the polar coordinate image; and

comparing the rotated polar coordinate image and specified mark candidates to determine the specified mark.

20. A computer program containing instructions for generating a dictionary and for detecting a specified mark, the instructions comprising the tasks of:

inputting a specified mark image;

converting the specified mark in a polar coordinate image expressed by a central distance to a predetermined center and a central angle;

storing the polar coordinate image in a dictionary;

rotating the polar coordinate image; and

comparing pixels in the rotated polar coordinate image and corresponding pixels in specified mark candidates to determine the specified mark.

21. A storage medium for storing a computer program containing instructions for generating a dictionary and for detecting a specified mark, the instructions comprising the tasks of:

inputting a dictionary image;

generating a coordinate conversion table containing a list of corresponding coordinates between a predetermined XY coordinate and a predetermined polar coordinate for converting the inputted dictionary image into polar coordinates, the polar coordinates being expressed by a central distance to a predetermined center and a central angle; and

generating a polar coordinate image for the dictionary from the dictionary image based upon the coordinate conversion table.

22. The storage medium for storing a computer program containing instructions according to claim 21 wherein the dictionary image contains pixels, the central distance being in a central direction scale indicative of a distance between a center of each of the pixels and a center of the dictionary image in the predetermined XY coordinate, and the central angle being in a central rotation direction scale indicative of a degree of rotation of the dictionary image.

23. The storage medium for storing a computer program containing instructions according to claim 22 wherein one of the pixels having the same distance in the central direction is selected, the central angle of the selected pixel being used as a standard, the central rotation direction scale of other pixels having the same distance in the central direction being set to the central rotation direction scale of the standard.

24. The storage medium for storing a computer program containing instructions according to claim 23 wherein a rotated image is being rotated based upon the central angle of the standard, pixels having the same central direction scale being extracted from the rotated image, in determining pixel values in the polar coordinate based upon the extracted pixels, the central angle of the standard, a weight value being made large for a pixel value of the standard.

25. The storage medium for storing a computer program containing instructions according to claim 24 further comprising the additional tasks of:

storing the coordinate conversion table and the polar coordinate image in a dictionary;

rotating to reconstruct an image based upon the coordinate conversion table; and

comparing the reconstructed image and specified mark candidates to determine the specified mark.

26. The storage medium for storing a computer program containing instructions according to claim 24 further comprising the additional tasks of:

storing the coordinate conversion table and the polar coordinate image in a dictionary;

rotating to reconstruct an image based upon the coordinate conversion table; and

comparing pixels between the reconstructed image and specified mark candidates to determine the specified mark.

27. A storage medium for storing a computer program containing instructions for generating a dictionary and for detecting a specified mark, the instructions comprising the tasks of:

inputting a specified mark image;

converting the specified mark in a polar coordinate image expressed by a central distance to a predetermined center and a central angle;

storing the polar coordinate image in a dictionary;

rotating the polar coordinate image; and

comparing the rotated polar coordinate image and specified mark candidates to determine the specified mark.

28. A storage medium for storing a computer program containing instructions for generating a dictionary and for detecting a specified mark, the instructions comprising the tasks of:

inputting a specified mark image;

converting the specified mark in a polar coordinate image expressed by a central distance to a predetermined center and a central angle;

storing the polar coordinate image in a dictionary;

rotating the polar coordinate image; and

comparing pixels in the rotated polar coordinate image and corresponding pixels in specified mark candidates to determine the specified mark.

29. An apparatus for generating a dictionary for detecting a specified mark, comprising:

a dictionary generation image input unit for inputting a dictionary image;

a coordinate conversion table generation unit for generating a coordinate conversion table containing a list of corresponding coordinates between a predetermined XY coordinate and a predetermined polar coordinate for converting the inputted dictionary image into polar coordinates, the polar coordinates being expressed by a central distance to a predetermined center and a central angle; and

a polar coordinate generation unit connected to said dictionary generation image input unit and said coordinate conversion table generation unit for generating a polar coordinate image for the dictionary from the dictionary image based upon the coordinate conversion table.

30. The apparatus for generating a dictionary according to claim 29 wherein the dictionary image contains pixels, said polar coordinate generation unit determining the central distance in a central direction scale indicative of a distance between a center of each of the pixels and a center of the dictionary image in the predetermined XY coordinate, said polar coordinate generation unit also determining the central angle in a central rotation direction scale indicative of a degree of rotation of the dictionary image.

31. The apparatus for generating a dictionary according to claim 30 wherein said polar coordinate generation unit groups the central distance into clusters, each of the clusters in the central direction being expressed by the polar coordinate.

32. The apparatus for generating a dictionary according to claim 31 wherein the clustering is performed based upon the central direction scale so that correspondence is one-to-one between the pixels between the dictionary image and the polar coordinate image as expressed in the polar coordinate.

33. The apparatus for generating a dictionary according to claim 31 wherein the clustering is performed based upon the central direction scale so that a substantial difference is

prevented in characteristics value between the central direction scale and the central rotation direction scale.

34. The apparatus for generating a dictionary according to claim 31 wherein a rotated image is being rotated based upon the central angle, pixels having the same central direction scale being extracted from the rotated image, pixel values in the polar coordinate being determined based upon the extracted pixels.

35. The apparatus for generating a dictionary according to claim 31 wherein one of the pixels having the same distance in the central direction is selected, the central angle of the selected pixel being used as a standard, the central rotation direction scale of other pixels having the same distance in the central direction being set to the central rotation direction scale of the standard.

36. The apparatus for generating a dictionary according to claim 35 wherein a rotated image is being rotated based upon the central angle of the standard, pixels having the same central direction scale being extracted from the rotated image, in determining pixel values in the polar coordinate based upon the extracted pixels, a weight value being made large for a pixel value of the standard.

37. The apparatus for generating a dictionary according to claim 36 further comprising:

a dictionary connected to said polar coordinate generation unit for storing the coordinate conversion table and the polar coordinate image;

an image input unit for inputting an image;

a mark candidate extraction unit connected to said image input unit for extracting specified mark candidates from the inputted image;

a matching unit connected to said dictionary and said mark candidate extraction unit for rotating to reconstruct an image based upon the coordinate conversion table, said matching unit comparing the reconstructed image and the specified mark candidates to determine a specified mark.

39. The apparatus for generating a dictionary according to claim 36 further comprising:

a dictionary connected to said polar coordinate generation unit for storing the coordinate conversion table and the polar coordinate image;

an image input unit for inputting an image;

a mark candidate extraction unit connected to said image input unit for extracting specified mark candidates from the inputted image;

a matching unit connected to said dictionary and said mark candidate extraction unit for rotating to reconstruct an image based upon the coordinate conversion table, said matching unit comparing pixels between the reconstructed image and specified mark candidates to determine the specified mark.

40. An apparatus for generating a dictionary for detecting a specified mark, comprising:

a dictionary generation image input unit for inputting a specified mark image;

a polar coordinate generation unit connected to said dictionary generation image input unit for generating a polar coordinate image from the specified mark image based upon a predetermined coordinate conversion table, the specified mark in a polar coordinate image being expressed by a central distance to a predetermined center and a central angle;

a dictionary unit connected to said polar coordinate generation unit for storing the polar coordinate image; and

a matching unit connected to said dictionary unit for rotating the polar coordinate image based upon the coordinate conversion table, said matching unit comparing the rotated polar coordinate image and specified mark candidates to determine the specified mark.

41. An apparatus for generating a dictionary for detecting a specified mark, comprising:

a dictionary generation image input unit for inputting a specified mark image;

a polar coordinate generation unit connected to said dictionary generation image input unit for generating a polar coordinate image from the specified mark image based upon a predetermined coordinate conversion table, the specified mark in a polar coordinate image being expressed by a central distance to a predetermined center and a central angle;

a dictionary unit connected to said polar coordinate generation unit for storing the polar coordinate image; and

a matching unit connected to said dictionary unit for rotating the polar coordinate image based upon the coordinate conversion table, said matching unit comparing pixels in the rotated polar coordinate image and corresponding pixels in specified mark candidates to determine the specified mark.